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IDENTITY MATCHING OF CONSONANT-VOWEL-CONSONANT WORDS BY PREREADERS

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Using an identity matching-to-sample procedure, normally developing prereaders who matched individual letters with high accuracy (e.g., *m* and *s*) did not show high accuracy in matching three-letter printed words that differed only in the first letter (e.g., *mad* and *sad*). Teachers and researchers should not assume that children who can discriminate individual letters can also discriminate minimally different words that contain those letters.

DESCRIPTORS: identity matching, reading, stimulus control, complex stimuli

Beginning readers must learn to recognize individual printed letters within complex, whole-word stimuli. Without this skill, they cannot apply the alphabetic principle, defined as knowledge that "phonemes can be represented by letters, such that whenever a particular phoneme occurs in a word, *and in whatever position,* [italics added] it can be represented by the same letter" (Bryne & Fielding-Barnsley, 1989). The importance of recognizing individual sounds within spoken words (i.e., phonemic awareness) is broadly recognized. In contrast, the visual part of the letter–sound relation has received relatively little attention. Teachers and researchers sometimes assume that students who discriminate printed letters presented individually can also focus on individual letters within whole words. Thus, the skill is not always taught directly.

There is evidence, however, that visual discrimination tasks involving complex (multielement) stimuli may be difficult despite perfect performance with individual elements (Stromer, McIlvane, Dube, & Mackay, 1993). Might such difficulty be encountered in beginning readers' discrimination of printed words? Using an identity matching-to-sample procedure, we asked whether normally developing prereaders who demonstrate highly accurate discrimination of individual letters also readily discriminate two words that differ only in the first letter (e.g., *sad* and *mad*). In our procedure, accurate performance required that the participant focus on the first letter of a consonant-vowel-consonant (CVC) word.

METHOD AND RESULTS

Four prereaders, all at or above age level on the Peabody Picture Vocabulary Test, participated. They were Ken (male, aged 4 years 4 months), Eva (female, 5 years 9 months), Ann (female, 5 years 10 months), and Meg (female, 3 years 6 months).

One session was conducted on most weekdays. Except where noted, all sessions had 24 trials. All matching trials were presented by a computer with a touch-sensitive monitor screen. Trials began with the presentation of a sample stimulus in the center of the screen. Touching the sample added two choice stimuli, presented randomly in any two of the four corners of the screen. The stimuli were one, two, or three 1.5-cm

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lowercase letters. One choice was always physically identical to the sample, and touching it produced a 2-s auditory jingle and the automated delivery of a penny. Touching the nonmatching choice produced a 1-s black screen. The intertrial interval was 3 s; touching the screen during the intertrial interval reset the timer.

First, we pretested individual letter discrimination. The initial bars in Figure 1 show these results. Participants first were asked to name each lowercase letter of the alphabet presented individually. Ann and Eva showed near-perfect accuracy. Because the younger participants named few letters, their discrimination was tested using matching procedures. There were 26 trials in these sessions, each presenting a different alphabet letter as the sample. Both participants showed at least 90% accuracy in simultaneous matching, and also on the more difficult zero-delay matching. In the latter, the sample stimulus disappeared before the choices appeared, requiring the participant to select the matching choice letter without directly comparing it to the sample. Neither participant made matching errors with letters used in the study.

Next, we presented the CVC-word simultaneous matching task. We report the data in two parts, reflecting differences in teaching procedures. In both parts, each word pair was presented until a mastery criterion was met. Given the focus of this brief report on the relationship between the children's single-letter and CVC-word matching, however, complete acquisition data are not presented. We present only the data necessary to document the children's skills before training, and to illustrate improvement in initial accuracy over successive word pairs.

Part 1: Whole-Word Teaching Only

Part 1 had 3 participants, Ken, Eva, and Ann. One choice pair (e.g., *sad* and *mad*) was presented under trial-and-error teaching procedures until the child matched the randomly presented sample (e.g., either *sad* or *mad*) to the corresponding comparison on four consecutive trials. Then, a new word pair was presented (e.g., *set* and *met*). There were 10 word pairs; each included a word beginning with *m* and a word beginning with *s*. All vowels were included at least once, and there were several different final consonants. Figure 1 shows the word pairs presented to each participant. When participants met criterion on at least 10 word pairs, and there was no more than one error cumulated across at least four word pairs, maintenance sessions containing a mixture of 10 previously mastered word pairs were presented.

The top panel of Figure 1 shows the percentage of correct responses on the first four trials each time the word pair changed. All of the children made some errors. Eva and Ann consistently showed perfect accuracy after two to eight word pairs. Across 18 word pairs, however, the youngest child (Ken) usually made errors each time the word pair changed.

Part 2: Letter-by-Letter Teaching Procedure

Part 2 provided additional evidence of difficulty with CVC identity matching, and further demonstrated differences between single- and multiple-letter matching. It included Ken (from Part 1) and a new participant, Meg. In Part 2, we trained word matching letter by letter, with a letter added each time the correct selection was made on four consecutive trials. As in Part 1, the training of each word pair continued until there were four consecutive correct trials with three-letter words, but complete acquisition data are not shown.

To illustrate performance differences between single- and multiple-letter matching, Figure 1 shows data from early in the training of each word pair. For Ken, the first and fifth word pairs were trained beginning with

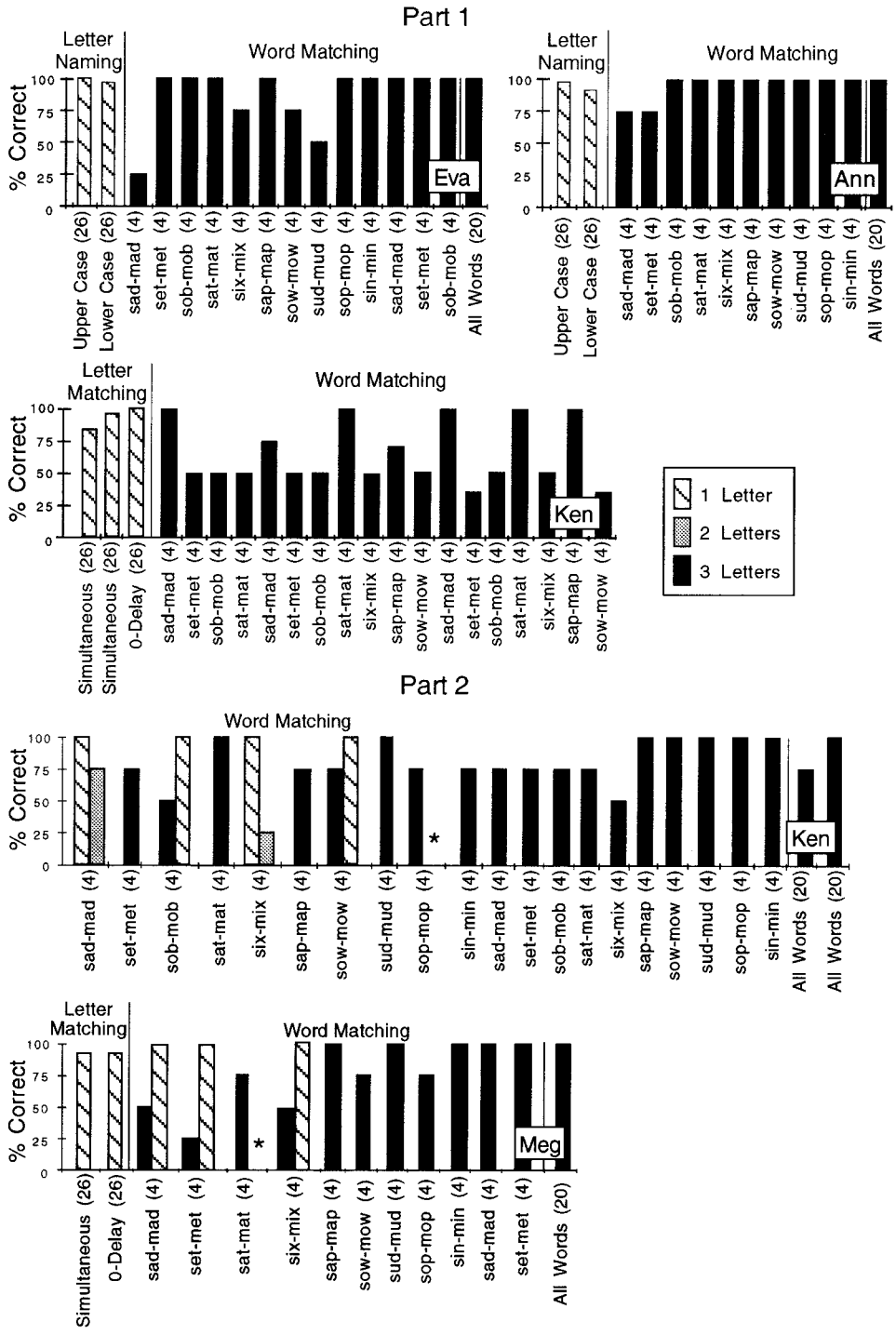

Figure 1. The percentage of correct responses in Parts 1 and 2. The number below each bar indicates the number of trials included in the accuracy calculation. The word pairs presented are shown along the horizontal axis. For Part 2, we present only the first one or two teaching steps, even though all of the word pairs were taught to a criterion of four consecutive correct. The asterisk above *sop/mop* for Ken and *sat/mat* for Meg indicates a programming error: The program branched to two-letter, rather than one-letter, training. These data are not shown.

the single-letter step. For these word pairs, data from the single- and two-letter steps are shown. For all other word pairs for Ken and for all word pairs for Meg, the training of each word pair began with the whole word, allowing us to probe whole-word accuracy each time a new word pair was presented. The one- and two-letter training steps were presented conditionally upon low accuracy with the whole word, usually after two consecutive errors. When training began with the three-letter step and acquisition occurred within that step, only a single bar is shown. If training branched to the single-letter step, data from the first four trials with single letters are also shown. Accuracy with single letters was always perfect. In contrast, at first, errors were almost always made on the two- and three-letter steps.

DISCUSSION

The children, particularly the youngest 2 (Ken and Meg), did not initially focus on the first letter of a CVC word even though (a) their discrimination of letters presented individually was nearly perfect; (b) the relevant feature of every CVC word was the same (beginning with *m* or *s*); (c) that relevant feature was always the beginning letter, with subsequent letters always irrelevant; and (d) every correct response produced a reinforcer. When the beginning letters were presented in isolation, accuracy was nearly perfect. Previous studies have demonstrated related difficulties (i.e., incomplete stimulus control) with complex stimuli, using both nonsense stimuli (Stromer et al., 1993) and real words (Birnie-Selwyn & Guerin, 1997).

We taught CVC-word matching with straightforward instructional programming, and it seems unlikely that our teaching procedures are unique in their effectiveness. Perhaps the greater significance of these findings lies in documenting the discrepancy between the children's discrimination of individual letters and their discrimination of printed words. Teachers and researchers should not assume that children who can discriminate individual letters can also focus on those same letters embedded in words. Failing to ensure this skill could seriously compromise reading instruction.

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